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EDITORIAL

GENITAL ABNORMALITIES IN THE GOAT

THE domestic goat has been called the poor man's cow, and quite rightly so, for goat-keeping is well within the economy of almost all men and the dividends they return in milk and meat are such as would gladden the heart of the most exacting investor. Moreover, the goat is almost exempt from many of the diseases which affect the cow and are a danger to man, especially tuberculosis. Therefore it is not surprising that this source of relatively safe milk, at an economic price, has led to a greatly increased interest in the animal, and nowadays the goat is to be found not only in the poor man's stable, but also on the rich man's estate. The necessities of war have acted as a spur to this process. Steps have been taken by judicious selection to enhance the qualities of the various breeds and to extend the lore of husbandry. This is all to the good, and in recent years we have witnessed a considerable numerical increase and also great improvements in individual and herd quality. This is apparent to anyone who has knowledge of the work of such bodies as the British Goat Society, or has visited the livestock section of any important agricultural show.

Man can direct and influence natural laws, but sometimes his efforts cause nature to rebel. Particularly is this so if, in his impatience, he tries to evolve and develop in a matter of decades what nature in her wisdom would assign to generations. Now, coincident with the enhanced status of the goat and their numerical increase, breeders of goats are faced with a developmental problem which so far has eluded all efforts to correct or control. We refer to the numerous cases of so-called Hermaphrodism. This is a problem which is causing

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serious concern to goat-keepers, and the detailed report, published in this issue, of the evidence presented at the ante and post-mortem examination of one particular specimen will give our readers some idea of the problems to be faced. It is a problem which calls for the closest collaboration between breeder, the veterinary surgeon, the geneticist and the academic scientific worker. Already our knowledge of genetics, including as it does those problems associated with hereditary influences and sex determination, has made great progress. Much is clear that was obscure and for generations ascribed to chance, judgment or even intention. Here is a field in which all concerned may delve with zest, and by collaboration bring lasting benefits not only to the particular species involved, but, by applying the lessons learned, to the entire range of domesticated animals.

ABSTRACT

ANNUAL REPORT OF THE U.S. BUREAU OF ANIMAL INDUSTRY*

THE annual report of the chief of the U.S. Bureau of Animal Industry for the year ending June 30, 1944, conforms to the growing dimensions of America's veterinary problem. It tells the story of the principal diseases that threaten the health of the country's livestock, and the methods in force to control them in the effort to comply with the government's accelerated programme of animal production.

The report is a reminder that the animal-disease potential is a veritable ambuscade that has to be kept down by vigilant discipline, scientific research and forceful police work, in spite of the hazards of a global war in the face of manpower shortage and a mounting animal population. Hog cholera, tuberculosis, brucellosis of cattle and swine, swine erysipelas, salmonelloses of poultry and hogs, bovine mastitis, and various metazoan parasitisms are among other enemies of animal life that must be kept in check to prevent serious drain on the nation's supply of protective food: meats, milk, poultry, eggs, fats. The report contains the directives by which these impediments to animal health have been kept under control in spite of war-time handicaps. The United States is not threatened with the flare of any serious animal plague, owing to organised frontal attacks directed by the Bureau of Animal Industry in collaboration with the state services. Exception is made of bovine brucellosis, the handling of which, though nation-wide, remains somewhat polemic. There is controversy among the state agencies as to the best plan of mastering that widespread disease. The chief of the Bureau lays down a plan and proposes its universal adoption. It comprises every known means of combating that insidious infection.

* Report of the Chief of the U.S. Bureau of Animal Industry, 1944.

General Articles

HUMAN AND BOVINE TUBERCULOSIS

By J. W. RAINEY, C.B.E., M.R.C.V.S.,
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In a former article (Veterinary Journal, November, 1944) I attempted to show, by means of a close analysis of clinical experience and vital statistics in several countries, that there had been in some respects, and to a notable extent, a misconception of the relationship of bovine to human tuberculosis.

This effort to expose a fallacy was not made in any destructive or mischievous spirit; it was undertaken by the writer from a sense of public duty in order to correct what he had found to be a general error in English-speaking countries. That is, a wholly false impression among both veterinarians and medical men, as a rule, that the verdict of John MacFadyean and the Royal Commission that upheld it, to the effect that bovine tuberculosis was a menace to humanity, applied equally throughout the world.

This almost universal professional faith had permeated the laity to such an extent that wherever one went throughout the world one found nurses, politicians, hygienists, and publicists generally, putting the fear of cows' milk into the hearts of the people, quite irrespective of statistical or biological fact.

In the former article reference was made particularly to vital statistics in Tasmania, Queensland and South Africa, and it is proposed here to extend the study to Victoria, in Australia. In submitting such evidence and in drawing general conclusions from it—and this applies also to the former article—the writer would make the reservation that it is nearly all drawn from the southern hemisphere.

It may be that there are physico-chemical differences between the southern and northern hemispheres, and consequently a difference in human resistance, as regards the relation of bovine to human tuberculosis that would make observations in this respect in Australia or South Africa invalid for Europe or North America. Except on the assumption that such differences do exist—due in part, perhaps, to the greater marine and solar influences in the southern hemisphere —it is hard to account for such significant facts as that the bovine strain of the tubercle bacillus in Australia is never found in human tuberculosis of bones and joints.

In recent British work, however, considerable differences have been brought to light concerning the incidence of non-pulmonary tuberculosis in humans in parts of Scotland as compared with Southern England, with especial reference to tuberculosis of bovine origin. Consequently, it seems fair to assume that the great difference in this respect between the southern and northern hemispheres is only an extension in degree of similar differences found more or less everywhere in conformity with laws roughly defined by the writer in his former article.

The following observations on tuberculosis in Victoria in the light of Australian vital statistics are based on facts given in the Australian Year Book, and by Dr. M. J. Holmes, Senior Medical Officer, Commonwealth Department of Health, in an article entitled "Tuberculosis in Australia," that appeared in the *Medical Journal of Australia,* November 6, 1937.

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Human and Bovine Tuberculosis in Victoria

More intensive bacteriological work on the part played by the bovine bacillus in human tuberculosis has been done in Melbourne, Victoria, than anywhere else in Australia, mainly because in the Melbourne area the physico-chemical conditions seem to favour the virulence of the bovine bacillus or to lower human resistance to it more than is found in other parts of the Australian mainland or in Tasmania. No one who has arrived in greater Melbourne on a foggy winter's morning would wonder at this; no great city anywhere in the southern hemisphere is more physically reminiscent of the Old Country than Melbourne at such a time.

Nevertheless, it is found that even in Southern Victoria the bovine bacillus plays a minor part in human disease as compared with experience in Britain.

If the proportion of human cases of bovine origin in North Britain be agreed as being about 30 per cent. of all non-pulmonary cases, then the incidence in Victoria is about one-tenth, or less than 3 per cent.

A striking instance of the over-estimation that seems to prevail, even in Australia, as to the part played by the bovine bacillus in human disease, is found in the following quotation from an article by Dr. R. Webster in the *Medical Journal of Australia,* July 19, 1941. The article is entitled: "The Relative Incidence of Human and Bovine Types of Myco-bacterium Tuberculosis in Human Beings in Victoria."

Says Dr. Webster: "Bovine-type bacilli were found in non-pulmonary tuberculosis material from 11 (8.99 per cent.) of 125 children of 14 years or younger, and none of 183 adults. The decline from the 1932 figures of 25.9 per cent. in children is correlated with the introduction of tuberculin testing of dairy cattle." Here one has typically the very thing to which the veteran philosopher, Bernard Shaw, objects so vehemently and reasonably in his book, "Everybody's Political What's What." That is, the presentation of vital statistics in a vacuum. Considered thus, in a statistical vacuum, the figures given by Dr. Webster must lead the uninitiated reader to conclude that by reason of the tuberculin testing of cows, and by this means alone, human tuberculosis of bovine origin was reduced by two-thirds, or about 60 per cent., in Victoria during the decade 1931 to 1941.

And now to take Dr. Webster's statistics out of their vacuum and to compare them with Australian vital statistics, and the statistics of non-pulmonary tuberculosis generally, for the same decade, not only in Victoria but in other Australian mainland states; South Australia, for instance, and Western Australia, where, by reason of paucity of veterinary staff, intensive use of the tuberculin test throughout the state was quite impossible. Dr. Holmes, in his above-mentioned article, shows that between 1930 and 1935, not only in Victoria but in New South Wales, South Australia, and Western Australia, the annual mortality from non-pulmonary tuberculosis dropped more than 20 per cent., thus continuing a steady decline which had been going on at about the same rate for more than thirty years.

Thus in Victoria between 1931 and 1941 a marked decline in mortality from all cases of non-pulmonary tuberculosis in human beings would be statistically expected, and did actually occur at a rate not much less than that observed by Dr. Webster for tuberculosis of bovine origin.

A comparative study of the relevant statistics, therefore, proves that some

general anti-tuberculous influence was at work during this decade which, quite apart from tuberculin testing, not only in Victoria but in three other states, was bound to cause a sharp decline in the number of deaths allegedly due to bovine infection.

The fact that the general decline was particularly great in cases allegedly of bovine origin may be due to a statistical rule or law, observed elsewhere, that when environmental conditions combine to cause a rapid decline in the incidence of human tuberculosis, it is non-pulmonary tuberculosis in general and tuberculosis allegedly due to bovine infection in particular that decline most.

Consequently, with all these statistical facts before us it can only be conceded that tuberculin testing played a minor or secondary part in the reduction noted by Dr. Webster. To claim that it played the whole or even the major part is to ignore the statistical context and to reason in a vacuum.

Human tuberculosis of bovine origin, like all tuberculosis, but to a greater degree because of its exotic character in relation to man, is biologically and statistically linked with environmental influences rather than with specific infection. The decade 1930-1940 rounded off a thirty-year period of a catastrophic fall in the Australian birth-rate, wherein the number of children in the average home was nearly halved. Consequently, the danger of mass infection was halved for human tuberculosis in general, more than halved for non-pulmonary tuberculosis in particular, and much more than halved for that form of tuberculosis which, being exotic, can only take effect under the best conditions for the germ and the worst for the victim.

In all logical likelihood, in all statistical probability, the reduction noted by Dr. Webster was due much more to more space, more food, more segregation of cases, and all the other domestic ameliorations that are apt to occur in hygienic respects when the birth-rate falls, than to tuberculin testing.

In Natal, Queensland, and even Tasmania, for instance, in recent years tuberculin testing for the first time in certain areas has revealed the existence of what must have been old-standing "pockets" of tuberculosis in cattle, whereby numerous children over long periods were exposed to potential bovine infection. Yet there is not the slightest evidence to show that the incidence of non-pulmonary human tuberculosis in such areas was any higher than elsewhere.

In this connection, since the writer presented his first article, remarkable evidence of the heavy tuberculosis infection of dairy herds in the coastal districts of Queensland has come to hand in an article in the *Australian Veterinary Journal* for December, 1944.

Messrs. A. L. Clay, B.V.Sc., and R. E. Churchward, B.V.Sc., of the Animal Health Station, Townsville, Queensland, in this article, described "An attempt to eradicate the disease from two badly infected herds."

At the first test by tuberculin the "positives" numbered 48 out of a herd of 211 cows, all supplying milk for human consumption in North Queensland.

After three more tests at three-monthly intervals there were no reactors.

A sixth test, made 15 months after the first test, showed 93 "positives" out of 240 cows.

Such disclosures prove the absurdity in a great country like Australia of expecting that, with a bare handful of veterinarians, there can be anything like the total eradication of tuberculous cows, especially under sub-tropical conditions. In South Australia, for instance, there is hardly a qualified veterinarian outside the city of Adelaide, and even here in little Tasmania we lack the veterinary

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staff that would be needed to test cows with the frequency necessary to be sure that there was no such relapse as discovered by Messrs. Clay and Churchward in Queensland.

What need, then, have we of further proof that throughout Australia as a whole our relative freedom from tuberculosis of bovine origin is not in the main "correlated with tuberculin testing?"

Human Tuberculosis of Bovine Origin in Negroes.

Those who are interested in the subject of this paper should be curious to know what has been the effect of the eradication of tuberculous cows and the pasteurisation of milk in the United States on the incidence of tuberculosis in negroes. The racial and environmental factors as they affect the negro under industrial conditions should make him very susceptible to tuberculosis of bovine origin.

Consequently, on theoretical grounds one might have expected a dramatic drop in mortality from non-pulmonary tuberculosis among negroes in American cities in recent years.

Has there been such a drop, and if not, why not?

Similarly, in South Africa, where millions of negroes in the native reservations are exposed to potential infection from the milk of thousands of tuberculous cows, there should, on theoretical grounds, be a high incidence of tuberculosis of bovine origin.

Is there such an incidence, and if not, why not?

Here is a rich and—the writer imagines—almost a virgin field for research, and it is perhaps socially significant that it has received even less attention than the veterinary aspect of the matter.

A CASE OF INTERSEXUALITY (HERMAPHRODISM) IN A HORNED GOAT

By C. W. OTTAWAY, *Department of Anatomy, Royal Veterinary College,*
and
R. H. ARNOLD, *Veterinary Investigation Department, University of Reading.*

INTERSEXUALITY is known to be a common occurrence and to be the major cause of absolute sterility in certain breeds of goats, presenting a serious problem to the goat industry. Eaton and Simmonds (1939) have reported an incidence of 11.1 per cent. of hermaphrodites in Saanens and 6 per cent. in Toggenburgs. Paget (1943), in a survey of selected British Saanen herds, recorded 14.3 per cent. of the kids as visible hermaphrodites at birth. Horned hermaphrodites are, however, rare, and there are few authenticated cases. Asdell (1944) found none in over 200 cases examined, and Paget (1943) none in 52 cases, although this author records three cases as having been reported to him, and that he has seen another. Asdell (1944) has suggested a close linkage between the gene for hornlessness and the gene for intersexuality, and states further that goat breeders have evidently been increasing the gene frequency for intersexes by selecting for hornlessness. The following case is reported, not only as evidence of a horned hermaphrodite, but also in the hope that the detailed findings given may be of assistance to those engaged in research on this problem.

The goat was a three-quarter British Toggenburg—one-quarter British

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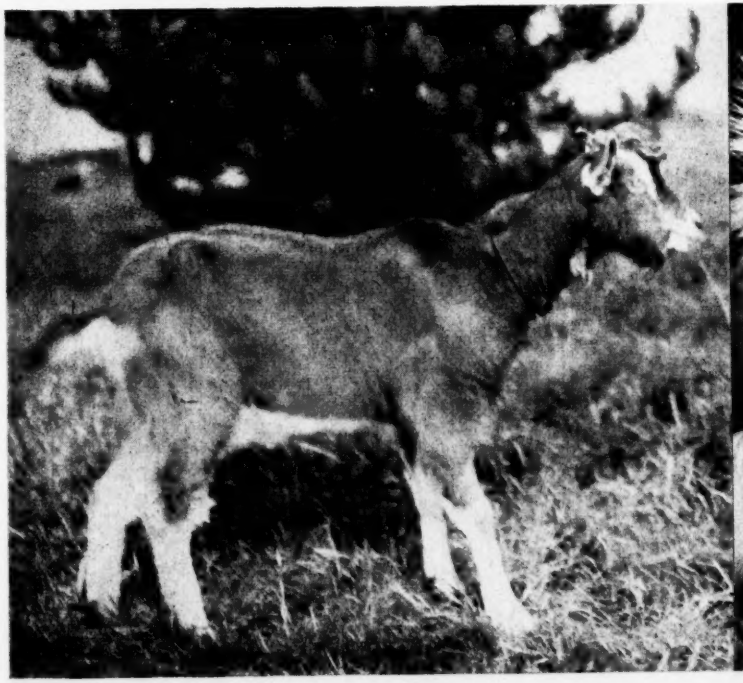

FIG. 1.
The goat at six months of age (Note: Masculine-type head with beard and prominent forelock).

FIG. 2.
To show the nature of the penile-clitoris—the glans is being projected through the preputial orifice. Part of vulvar cleft is seen immediately above the clitoris.

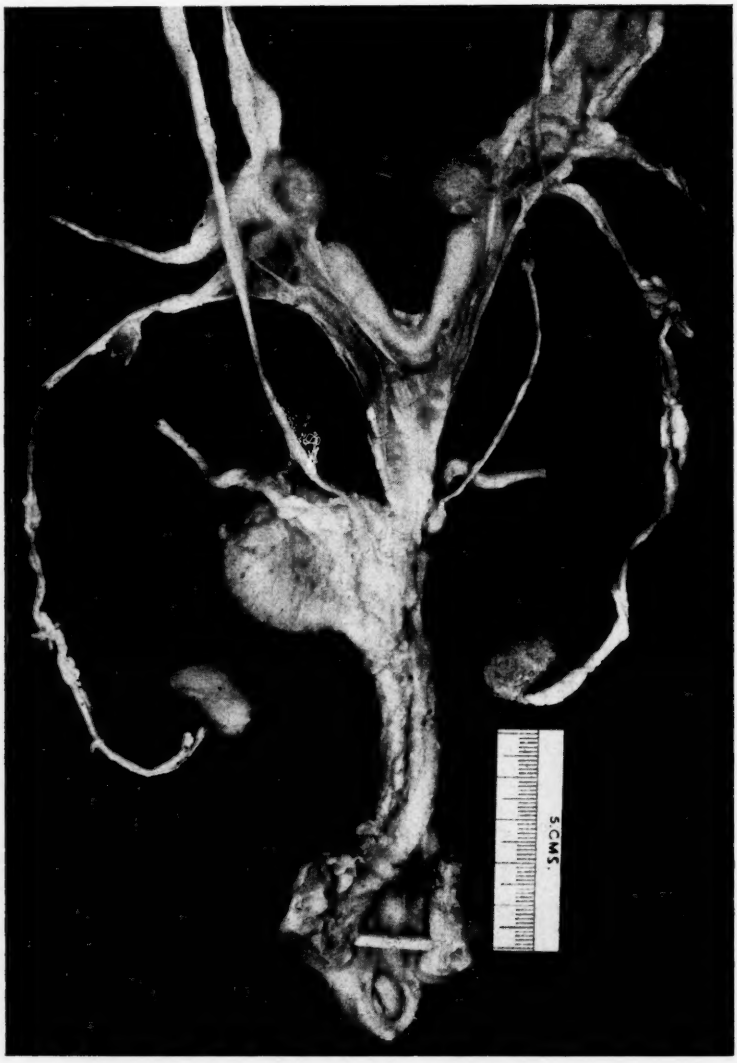

FIG. 3.
Dorsal view of dissected genitalia. The location of organs is indicated on the outline drawing 3a.

Saanen cross, and at birth was recorded as a normal female kid. It was the last born of four, the remainder being normal males. The sire was a hornless Toggenburg with no history of hermaphrodism in his family for two generations. The dam was hornless; her previous litter was normal and she has since produced two normal kids, a horned female and a hornless male, to another sire. Male habits were noticed in the animal by the owner at three months, the goat attempting to mount others. The clitoris was enlarged. When examined by the authors it was six months old, and, as seen in the photograph taken immediately before that time (Fig. 1), had a somewhat masculine head and neck with beard and prominent forelock. The right horn can be seen behind the right ear; it is misshapen, due to an unsuccessful early attempt at disbudding. The general habits were masculine.

The external genitalia were feminine in character, the vulvar cleft being 37 mm. in length. The ventral commissure was bulbous and displayed a well-

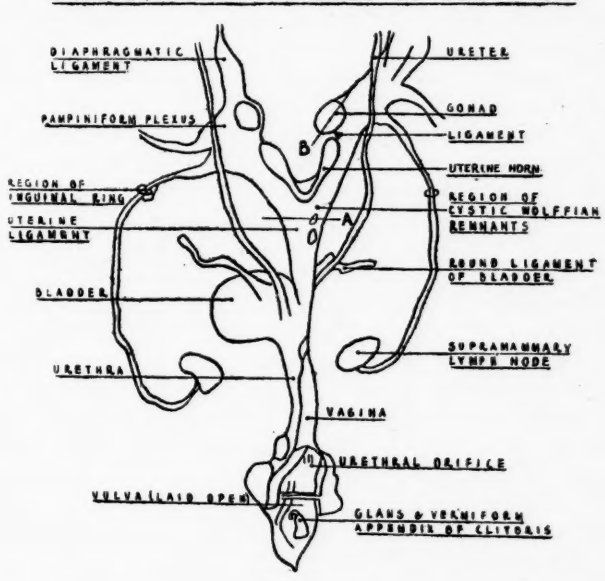

FIG. 3A.

developed penile-clitoris enclosed within a prepuce (see Fig. 2). This organ measured 5 mm. in diameter and was about 30 mm. long; it could be easily projected through the opening of the prepuce to expose a recognisable glans and raphe glandis. On the free end of the glans was an appendix resembling the urethral process. This process had, however, no lumen, and urine was passed through a large external urethral orifice, situated, as in the normal female, at the vulvo-vaginal junction, 34 mm. cranial to the penile-clitoris.

Two mammary glands were present, but mammary development was slight, apart from the teats. Caudal and lateral to the mammary glands in the external inguinal region were two almond-shaped bodies suspended in a moderate amount of fat. Histological examination revealed them to be lymph nodes; they were classified, therefore, as the supra-mammary lymph nodes.

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The internal genitalia are shown in Fig. 3. The kidneys and ureters were normal. The urethra was large and more muscular than the normal female urethra; no connection was found between it and the base of the penile-clitoris. A few small eminences were found at this site; but histological examination revealed no evidence of prostatic tissue. The vagina ended blindly 6 cms. cranial to the urethral opening; its histological appearance was normal. A uterine body and cervix were absent. A peritoneal membrane (presumably representing the broad ligament and designated in this account as the uterine ligament) connected the end of the blind vagina to the bifurcation of the uterine horns. The uterine ligament enclosed cystic bodies, lined with transitional epithelium, and remnants of ducts lined with cuboidal epithelium. The two uterine horns formed a U-shaped organ suspended laterally by the cranial end of the uterine ligament and medially by a single intercornuate ligament; cranially they were united on either side of the gonad by a short ligament corresponding in position with the ovarian ligament. No fallopian tubes were present. Thus the uterine horns, which showed typical uterine histology, were blind at both extremities.

The gonads were suspended in the sub-lumbar region, the diaphragmatic ligaments being well developed. Each was an oval-shaped body consisting largely of testicular tissue. The seminferous tubules were lined by a single layer of cuboidal cells containing large vacuoles, the whole resembling a picture of hydropic degeneration (see Fig. 5). Areas of rete testis and epididymis were also present, but no ovarian tissue was demonstrable. No sperms were present. Associated with the gonad was a pampiniform plexus of blood vessels. From the gonad a fibro-vascular cord, containing a small artery and accompanying vein, lymph vessel, nerve and fibrous tissue, passed in a peritoneal fold along the lateral aspect of the abdominal wall and through a very distinct inguinal canal to the supra-mammary lymph node in the extra-abdominal inguinal region.

The Wolffian ducts were poorly represented and no representation of Gaertner's ducts was present in the vaginal wall. On post-mortem it was thought that a deferent duct could be traced along the lateral borders of the uterine ligament, but, although sections revealed Wolffian remnants in some parts, there was no continuity of the lumen. If this area represents the point of fusion of the urogenital sinus with Wolffian and Müllerian remnants, it is possible that the glandular structures in the vicinity of the Wolffian remnants represent primitive seminal vesicles (see Fig. 4). The nodules around the cranial termination of the vagina contained areas of lymphoid tissue.

Discussion

There seems to be some doubt as to whether hermaphrodite goats are genetically males or females. Crew (1924) considers them to be genetic males which have come under the influence of female hormones during development, but the surveys of Asdell (1944) and Paget (1943) suggest that for Saanens, at any rate, their make-up is genetically female. In the absence of histological evidence of ovarian tissue our case must be considered as genetically male. There has been Müllerian growth, but none caudal to the fusion of the uterine horns, unless it be represented in the more cranial of the cystic bodies in the uterine ligament. There was little Wolffian growth, the only rudiments being the series of incomplete ducts running alongside the cystic bodies in the uterine ligament.

Absence of the uterine body and cervix is occasionally found in barren females of all species, especially in the bovine. In the present instance it will be

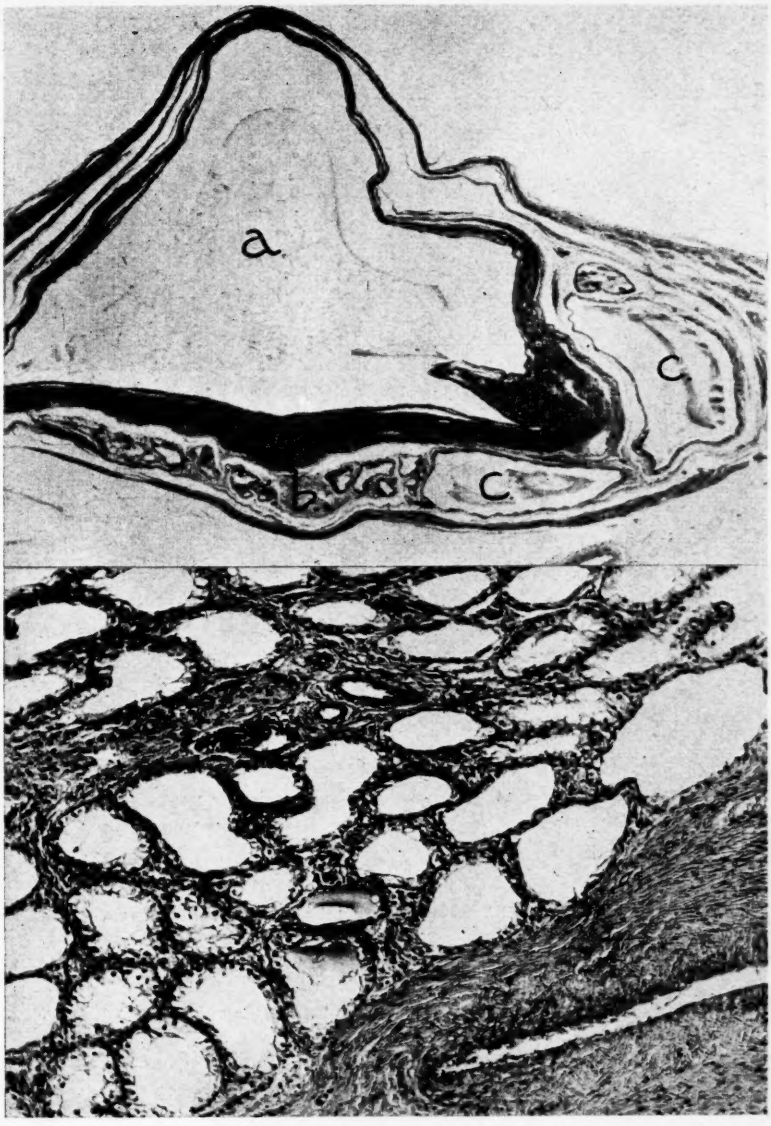

FIG. 4.

Cross section of uterine ligament at level marked A on figure 3a (x55). The suggested findings are: *a*—urogenital sinus: on either side of *b*—seminal vesicles: *c*—Wolffian ducts.

FIG. 5.

Cross section of part of right gonad at level marked B on figure 3a (x142). To show structure of the seminiferous tubules. Part of the pampiniform plexus is seen in the lower right hand corner.

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recalled that some of the cystic remnants in the uterine ligament were lined with transitional epithelium indicative of a probable origin from the urogenital sinus rather than from the Müllerian rudiments. It is probable that fusion of the urogenital sinus with the Müllerian and Wolffian complex has occurred in this membrane, and the cystic remnants represent the unorganised development of these structures (see Fig. 4). This would suggest that the urogenital sinus directly participates in the formation of the vagina in the goat.

Another feature worthy of comment is the arrangement of the structures passing through the inguinal canals. The gonads were connected with "inguinal cords" which contained an artery, vein, lymph vessel, nerve and fibrous tissue. Their connection with the gonads and the formation of perfect inguinal canals suggests an organisation more than sufficient to allow of the passage of these vessels from the abdomen to a lymph node in the extra-abdominal inguinal region. On this account it is suggested that these cords contained remnants of a chorda gubernaculum. That they did not function in assisting descent of the gonads is understandable, since, apart from the absence of normal hormonal control, the gonads were retained in the sub-lumbar region by their attachment to other structures. Eaton (1943) has suggested, but not elaborated on, a relationship between cryptorchidism and hermaphrodism. Our only contribution to this story is that the histological appearance of the gonad was not unlike that seen in a cryptorchid animal, i.e., when the gonad is intra-abdominal.

The birth of this goat as sibling to three normal males and the general appearance of the genitalia suggests that it was a freemartin. Again, at variance with the view of classical pseudohermaphroditism is the absence of intersexual animals in the pedigree of both parents. No evidence was available at birth, however, of fusion of the chorionic sacs in this case. Furthermore, we have been unable to find any reference to freemartin goats in the literature, and it is possible that they do not exist.

The chief point of interest in this case arises from the occurrence of the hermaphrodite condition in a horned goat. The structure of the genitalia is similar to but does not exactly correspond with any of those described by Eaton (1943). This aberration may be linked with the presence of the horns, and assuming a genetic basis for the intersex condition, the genetic factor responsible for horn growth may be associated with the gene for the type of genitalia exhibited in this case.

The linkage between the gene for hornlessness and that for hermaphrodism, as suggested by Asdell (1944), and quoted in the report of Chief of the Bureau of Animal Industry (1944), is not absolute.

Acknowledgments

We wish to express our thanks to Professor J. McCunn for the interest he has taken in the case; to Mr. H. E. Jeffery, secretary of the British Goat Society, for affording us the opportunity to make the investigation, and to Mrs. G. C. Hellyer, the owner of the goat, who has supplied us with the history of the animal and other useful information.

The micro-photographs were prepared by J. Hancock, Royal Veterinary College.

REFERENCES

Asdell, S. A. (1944): "Science," *99*, 124.
Crew, F. A. E. (1924): Proc. Roy. Soc. Series B., *95*, 90
Eaton, O. N., and Simmonds, W. L. (1939): *J. Hered., 30*, 261.
Eaton, O. N. (1943): *J. Amer. Vet. Res., 4*, 333.
Paget, R. F. (1943): *J. Brit. Goat Soc., 36*, 57.
Report of Chief of the Bureau of Animal Industry, U.S.A. (1944).

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IMPACTION OF THE CÆCUM

By W. W. LANG, M.R.C.V.S.,
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"It is not a pleasant ending this—a sudden and unexpectedly fatal one to a case the veterinarian at the outset deems simple."—REEKS.

IN view of the writings of Reeks and Pillers and the experience gained by the author, it would appear opportune to review the above condition, which is the most insidious of all forms of colic and for years has perplexed the veterinary surgeon and owner alike.

The writer agrees with the opinion expressed by Pillers that the larvæ of the strongylus vulgaris are a probable cause of colic in cart-horses; in his (the writer's) view the parasite is the greatest enemy of the equine race in this country. In 100 consecutive cases examined post-mortem in this area 83 were found to have suffered circulatory damage to the anterior mesenteric artery due to the parasite, and in every case of death from cæcal impaction and ruptured bowel there was evidence of this condition. True, there may be contributory causes, such as insufficient water, but, generally speaking, the chief agent is the parasite.

"Olt, Mollmann and others have attributed most importance to the damage of the cœliac and anterior mesenteric plexuses as the larvæ enter the artery from without. Bollinger in one of his conclusions wrote:—'Owing to the fibrous thickening of the connective tissue at the root of the anterior mesenteric round the aneurysm and to the considerable size of the latter disturbances of innervation of the intestine . . . may well be at the root of many chronic disturbances of digestion in horses.'

"It seems to me that the important intrinsic states which bring about colic can be grouped as follows:—

"1. Alterations in the normal movements of the bowel: (a) paralysis, (b) atony, (c) spasm, (d) hyperperistalsis.

"2. Alteration in the nature of the secretions: (a) increase, (b) decrease, (c) arrest.

"3. Alteration in the functions of the nerve supply to the intestines: (a) vagus and (b) autonomic." (Pillers.)

The probable sequence of events in cæcal impaction is: penetration of the larvæ into the anterior mesenteric artery, thrombosis, fibrous thickening of the arterial wall and surrounding tissues with cicatricial constriction of the nerve supply resulting in enfeebled nervous and muscular action and more or less arrested glandular secretions, impaction, often slight diarrhœa and colic probably of short duration with, to the uninitiated, apparent recovery following the administration of the usual laxatives, inappetence for both food and water and a weak pulse 50-60, pressure necrosis, rupture and death at any time from 6-14 days. Occasionally death may occur from toxæmia alone without rupture.

For diagnostic purposes rectal exploration is the sheet anchor, as the impacted mass can be palpated easily.

Incidence

During November and December, 1944, 43 colic cases were presented to the writer, viz.: twist, 1; wheat poisoning, 1 (both fatal); impaction of the double colon, 33; impaction of the cæcum, 8. All 41 recovered.

Treatment

The first objective is to relieve the pressure of the food mass on the bowel with the least possible delay. Failure to do so within three days of the onset of clinical signs in many cases may mean a fatal issue from ruptured bowel. Over a period of years it has been found that a large volume of water plus medicinal agents is the first requisite; provided that no undue discomfort is shown; 12 gallons or so is administered per stomach tube, and on occasion a further supply has been given in an hour's time with gratifying results. Hydrotherapy appears to be well justified, because the bowel is subjected to such pressure that nervous and muscular actions are practically in abeyance and respond feebly, if at all, to medicinal agents. By mechanical flushing pressure on the bowel wall is relieved quickly, thus allowing the restoration of a measure of tone which is further enhanced by the addition of sod. bicarb. ℥viii and common salt ℥xii to stimulate peristalsis. In a few hours, or next day, watery evacuation often takes place with a return of appetite and normal pulse followed later by the passing of enormous lumps of dry fæces bearing the impress of the bowel. Provided that necrosis has not taken place, recovery is uninterrupted; owners are, however, warned to wait a fortnight lest untoward results follow.

A useful line of treatment, too, is the intravenous injection of common salt and sodium citrate, two pints of 5 per cent. each; some state that one pint is sufficient (personal communications). Piles of normal fæces—defæcation "not rudely swift nor tediously slow"—are to be found on the following visit and normal appetite and pulse. Care must be taken to administer the solution slowly to avoid "acute calcium deprivation" as indicated by restlessness, incoordination and prostration. Further, subcutaneous leakage must be prevented or a troublesome and long-standing swelling will follow. On occasion it has been found that flushing by a volume of water is also necessary, for reasons above stated, should the intravenous injection alone prove wanting.

This intravenous treatment was originally used for the purpose of dissolving the thrombus, and the writer is satisfied from p.-m. findings that this result can be obtained. Jones and Hewitt, as the result of their laboratory experiments, state the increased peristalsis is entirely due to the sod. and not to the chloride or citrate, and that sod. bicarb. is quite as efficacious.

Apart from the immediate results of sodium therapy there is lasting benefit to the patient—sodium is an extra-cellular element and is not retained—and the writer is therefore of opinion that decalcification of fibrous tissues formed as the result of verminous thrombosis is achieved, thus restoring normal digestive processes. In two animals only has there ever been a recurrence of cæcal impaction, and that two years later. Many cases of debility are quickly and permanently benefited by the administration of common salt alone per tube; some respond more readily to intravenous medication, which is the routine treatment successfully adopted here, to put an end to repeated colics, and gives gratifying results, too, in cases of fickle appetite and low condition, all due, in the writer's opinion, to the same common cause, viz.: the larvæ of the strongylus vulgaris.

Note.—Since writing the above two more cases have been seen. One, the only fatal one of the ten, died in spite of all treatment as indicated above; p.-m. was not possible. The second appeared to respond satisfactorily after two days' treatment but was reported again five days later. This time he had common salt 1 lb., sod. bicarb. ½ lb., in 12 gallons of water, but without success; a day

later this was repeated plus one pint of salt and sod. citrate 5 per cent. each, intravenously, with gratifying results. The combined treatment has not previously been given by the writer, but it may prove to be the correct procedure in intractable cases.

On the next occasion the intravenous medication will be given first because indications of acute calcium deprivation were much sooner in evidence than usual.

REFERENCES

Reeks, H. Caulton: "Common Colics of the Horse."
Pillers, A. W. Noel. "Some observations on colic in adult cart-horses due to the larvæ of strongylus vulgaris," *Veterinary Record*, November 24, 1934, No. 2,420, Vol. 46.
Roberts, Stephen J.: "The effects of various intravenous injections in the horse," *Veterinary Record*, July 29, 1944, Vol. 56.

THE PATHOGENESIS OF THE SOIL—A PLEA

By W. M. SCOTT, F.R.C.V.S., D.M.V., F.R.S.(Edin.),
Bridgwater.

Now that the scales are beginning to fall from the eyes of our political leaders and they are at long last realising the potential importance of a sound and active agricultural policy, this may be an opportune moment to discuss certain points, hypothetical and otherwise, pertaining to the soil in particular.

We must, in the first place, disabuse our minds of the old-fashioned doctrine that distributed throughout Nature there are things *animate* and *inanimate*. All Nature is animate. The only difference is a question of degree, which in itself revolves in turn upon its vibratory capacity. The greater the vibration the higher up the developmental scale is the particular entity to be found, and here on this plane, of course, man holds priority.

A Living Soil

The soil, then, must be looked upon as a *living* soil, and must be treated as such, but it does not follow that all soil is good soil. On the contrary. In this country there are thousands of acres of very bad soil, and the tragedy is so few people realise that vegetation grown on *bad* soil is liable to affect adversely the consumer, be it man or beast.

I use the expression, "bad soil," in a general sense as belonging to that type which produces vegetation capable of upsetting the body complex of the consumer.

For many decades the pathology of the human body has been closely studied. Of recent years pathologists have interested themselves in plant pathology, but how often does one hear of the pathology of the soil? And yet our prime source of existence springs from the living soil.

The majority of people seem to take it for granted that all soils are one and the same, and that if any diseased condition arises from the ingestion of that which springs from the soil it must be attributed to the product, and not to "the good earth," the producer.

Fallacious Reasoning

A brief consideration of this very vital point will show how fallacious this reasoning is.

Each plant is in itself a very complex bio-chemical laboratory, and many

of them highly sensitive at that, each extracting from the earth the essentials for its healthy existence; but not always, for sometimes deleterious elements are found in some soils and certain plants seem to have a predilection for these.

A case in point may be found in the so-called "teart" land in certain parts of Somerset. The soil here is blue clay, rich in *molybdenum*, allied to chromium. The grasses growing on this soil absorb the metal, and it has been proved that certain clovers extract the most, so that cattle grazing on such herbage undergo a slow poisoning, the symptoms being intestinal catarrh, diarrhœa, and malnutrition.

If this fact is kept in mind, and applied in a wider sense, one can readily see how an unhealthy soil bringing forth fruit, vegetables, and herbage may be the means of setting up disease in both man and beast. Now that intensive agriculture is going to be the order of the day it is of vital importance that a complete survey and careful analysis of the soil of this country should be made forthwith, and should be a first consideration of our scientific workers.

Scientific Research Needed

I do not know if such an intensive and universal investigation of the soil has been carried out in this country, but I do know that agriculture as practised in this island is, generally speaking, run on haphazard lines, which scientific research is necessary to correct. It is not enough for man to put the seed into the good earth and leave the rest to Nature. He must assist Nature, and where Nature fails or rebels science must step in.

The soil as we now know it was originally rock æons of ages ago, but by a process of disintegration by air and water the full complement of rock content with the passing of ages underwent a revolutionary change, and then vegetation arrived.

These plants in the process of their growth build up complex matter from the carbon dioxide from the air, mature, and die, and going into the soil they form a new group containing calcium, nitrogen, potassium, and phosphorus.

The mineral quantum in soil determines its nature and its consistency, i.e., sands, loams, clays.

Organic soils are composed of lignine, cellulose, proteins, carbohydrates, etc., etc., which turn, by the oxidising action of specific micro-organisms, first to nitrite, then to nitrate, and there are also to be reckoned with protozoa and soil fungi, but the exact role, favourable or unfavourable, these play needs further research work before they can be placed upon a sound footing.

Man Must Play Part

Soils in this island, as also all over the world for that matter, vary enormously, but it may be presumed, speaking generally, that the richer the soil in dietetic value, by which I mean the higher is the vitamin and mineral salt content necessary for the building up of the body complex—both human and animal—and carrying with them disease resisting capacities.

Where a deficiency of these essentials exists it is up to the ingenuity of man to make it up, and here intensive agriculture comes in, a principle which will loom large in the future, the key of which, of course, is embodied in manures, the most important being farmyard manures.

Up to now, generally speaking, the production and maturing of those valuable products have been run upon very haphazard lines, the farmer dumping

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them in heaps and allowing them to rot at will, the consequence being that the manure heap is nothing short of a solid mass of putrefactive material which if returned to the soil as such is a veritable poison to plant life of certain forms and in certain conditions.

The essentials of a successful compost heap are aerification, moisture supply, and heat, the objects aimed at being the stimulation of *fermentation,* and the *retardation* of *putrefaction.* Various methods have been tried out to attain these ends, but it would appear that Howard's Indore Process of Humus Manufacture is the most successful, for it is based on scientific lines.

Here it may be of interest to note the complex bio-chemical changes which take place in such a compost built up on these lines, i.e., intense fermentation soon sets in, accompanied by a rise of temperature, essential for bacterial growth, which in turn breaks down cellulose; fungi also become active and assist in the disintegration process.

The great objective of this process is the destruction of putrefactive organisms, and the stimulation of helpful organisms and fungi.

A Cause of Cancer?

As I have already hinted, the make-up of the average manure heap as it is to-day should be called the poison heap, for although it is capable of producing rich vegetation, such vegetation is saturated with toxic elements in many cases, which in turn are passed on to the consumer, and become a potential source of disease affecting both man and beast, not the least of which, probably, is cancer.

There is another aspect to consider. Such vegetation in itself carries with it a low immunological index. Consequently it is liable to bacterial and parasitic infestations, and if this deficiency is accepted as a fact then it must follow that there will also be a vitamin and salt content deficiency.

It must therefore follow that not only does such vegetation carry a low disease resisting index, but a disease activating capacity also. And can it be wondered at when one remembers the process of manufacture and the contents of farmyard manure at its source?

Cattle that are being fattened for the butcher are gorged to repletion with rich foods with little or no exercise; consequently the excretory organs are working overtime to rid the body complex of effete material consequent upon metabolic changes, and it must therefore follow that the fæces and urine from such animals are heavily charged with toxic elements, not to speak of bacterial infestations such as B. coli. in excess, and tubercle bac. and Johnne's bac. and their toxins.

A Source of Danger

It will therefore readily be seen that such manure, unless properly treated, passing into the soil becomes a potential source of danger to plant life and ultimately to man and beast.

Some soils carry with them a greater element of danger than others when thus treated; thus the light soils, such as loams and sands, giving good drainage and aeration, get rid of the poisonous factors more quickly than the heavy clays.

A very large percentage of the heavy clay soils of this country are "sour" through water stagnation and, by reason of their density, lack of aeration. The former can be overcome by intensive drainage; the latter by thorough and deep cultivation.

I am convinced that one potential factor in the production of cancer in man

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is to be found in the consumption of foods which have been grown particularly on "sour" soils and aggravated by the addition of putrid farmyard manure.

In support of this plea, may I mention there is a considerable belt of peat land in this county, which, of course, is very porous and light, and although the people indigenous to that neighbourhood live to a great age, I am given to understand that cancer is very rare indeed.

Conclusions

From the soil man lives and has his being, and what he puts into the living soil he takes out. How important then it is that the mother earth should be clean and wholesome.

To ascertain whether this is so or not the services of the chemist and the bio-chemist are called for, and attached to these should be a team of workers from the veterinary and medical professions, and members of the agricultural industry.

Intensive drainage, especially in heavy soils, should be carried out all over the country, while the farmyard manure heap should be built up on the scientific lines indicated.

If such methods carried out upon rigorous lines were universally adopted the fruits of the earth would help to eliminate disease and hasten the development of an A.1 nation.

Finally, I may add for over 20 years my kitchen garden has been nourished with nothing else than humus derived from a compost heap, thoroughly ærated, and composed of leaf mould, lawn mowings and a little horse manure, the latter to stimulate mycelial growth, and the result is I grow sweeter flavoured vegetables than I can get elsewhere.

Abstracts

THE PROPHYLACTIC EFFECT OF SOAPS IMPREGNATED RESPECTIVELY WITH TETRÆTHYLTHIURAM MONOSULPHIDE AND WITH BENZYL BENZOATE WHEN USED ONCE DAILY TO WASH RATS EXPOSED TO INFECTION WITH SCABIES DUE TO NOTOËDRES*

By R. M. GORDON and K. UNSWORTH

PREVIOUS investigations having shown that Tetmosol soap, i.e., soap impregnated with tetræthylthiuram monosulphide, gave protection from scabies due to *Notoëdres* amongst rats constantly exposed to infection from their companions, it was decided by the authors to find out whether protection could be achieved by a single wash with this soap once daily and, if so, what was the lowest concentration of the drug which would afford complete protection. The latter requisite is important (a) on the grounds of economy, as the cost of the soap would be affected by the amount of drug incorporated in each tablet to be used in communities exposed to infection with scabies, and (b) in order to reduce to a minimum any risk of dermatitis following the use of the impregnated soap. Since benzyl benzoate is known to be an efficient sarcopticide, soap impregnated with it was also used to see if it was capable of conferring a similar protection to that given by tetræthylthiuram monosulphide.

As the result of experiments, which are described, the authors found that

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10 per cent. Tetmosol soap applied once daily in the form of a lather containing approximately 1.8 per cent. tetræthylthiuram monosulphide completely protected four rats exposed to intense *Notoëdres* infection over a period of 16-17 days, whereas 10 per cent. benzyl benzoate soap, prepared and used in a similar way to the Tetmosol soap, provided no protection against the mites. A high proportion, but not all, of 12 rats exposed to a moderate *Notoëdres* infection over 14 days was protected when 2 per cent. and 1 per cent. Tetmosol soap was applied once daily as a lather containing respectively 0.4 per cent. and 0.2 per cent. of the chemical. On the other hand, 5 per cent. Tetmosol soap similarly applied as a lather containing 0.9 per cent. of the drug completely protected 12 rats over 14 days and a single rat over 16 days to a moderate and to an intense infection respectively with the mite. Gordon and Unsworth suggest that 5 per cent. tetræthylthiuram monosulphide, when incorporated into soap, represents the lowest concentration of the drug likely to give complete protection from scabies when the impregnated soap is used once daily.

J.N.O.

* *Annals of Tropical Medicine and Parasitology* (1944), Vol. 38, Nos. 3 and 4, pp. 207-212, 4 refs.

VETERINARY EDUCATIONAL TRUST

THE Council of the Veterinary Educational Trust announce the awards of the following Wellcome Research Fellowships:—

A Senior Wellcome Fellowship for Veterinary Research to Mr. Christopher W. Ottaway, F.R.C.V.S.

A Wellcome Fellowship for Veterinary Research to Mr. Herbert Williams Smith, M.R.C.V.S., B.Sc.(Vet.Sc.).

After qualifying in December, 1931, Mr. Ottaway was in veterinary practice for three years. He then entered the Anatomy Department, Royal Veterinary College, as a demonstrator, and is now senior assistant in the Department. He has worked at the School of Veterinary Anatomy, Leipzig, and at the Department of Anatomy, Brno University Veterinary School, and has published a number of papers on anatomical problems concerned with domestic animals. His research work under the Fellowship will be conducted at the Zoological Laboratories, University of Cambridge, and will be concerned with an investigation into the mechanics of the limbs of domestic animals and of factors which predispose to lameness and other diseased conditions. In this work he will have the advantage of close association with Professor J. Gray, F.R.S.

Mr. Williams Smith qualified in 1941 and has spent two years in private practice as an assistant. Since 1943 he has been an assistant veterinary investigation officer at the University College of North Wales, Bangor. He has contributed to the technical Press on the examination of milk samples for mastitis, and on the coagulese test for staphylococci. He has recently completed the examination of over 200 strains of staphylococci of animal origin, with particular reference to determining criteria of pathogenicity. His research under the award will be concerned with the epidemiology of staphylococcal infections in animals, and will be conducted under Professor G. S. Wilson at the London School of Hygiene and Tropical Medicine.

Both awards will take effect as from October 1 next.

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Abstracts of Current Literature

A VIBRIO ASSOCIATED WITH SWINE DYSENTERY*

DOYLE, of Purdue University, Indiana, reports the isolation of a vibrio from the colon of swine affected with the bloody dysentery that has caused heavy losses in congested swine-breeding districts. The organism was grown in pure culture which reproduced the disease experimentally in three to five days, although in less severe form than in swine-fed dysentery colon. The diarrhœa produced by the pure cultures, though less bloody and less mucoid, developed in six out of eight pigs to which the cultures were fed. In one pig, the reaction did not occur until the 24th day, and another pig had two recurrences. The isolation was accomplished by sealing shallow inoculated blood-agar plates with paraffin.

* *American Journal of Veterinary Research*, January, 1944.

SODIUM CHLORATE NOT HARMFUL TO SOIL MICROFLORA†

FACTS concerning the injury suffered by sheep, cattle and chickens exposed to sodium chlorate used to destroy weeds reported by McCulloch in 1939 (*Journal of the American Veterinary Medical Association*, December, 1939) suggested that this chemical may injure the useful microflora of arable land. Trials made by Nelson of the Minnesota Agricultural Experiment Station, in the laboratory and field, however, demonstrated that sodium chlorate in moderate concentration did not directly affect the spores of penicillium, aspergillus, fusarium and certain bacteria, but did, nevertheless, sterilise the soil of higher plant life. In the presence of micro-organisms, the chemical was found to be actually reduced at a rate corresponding to microbial activity, under poor aeration. In destroying weeds with sodium chlorate solution, better results are obtained in the autumn than during the warmer months. Weeds on poor soil respond better to its destructive action than weeds on moist, fertile soil.

† *Journal of the American Veterinary Medical Association*, June, 1944.

COD-LIVER OIL AS A FEED SUPPLEMENT IN CALVES‡

FROM the age of a few days to six months, 19 Guernseys, 25 Jerseys and 28 Holstein-Friesians were fed to test the value of cod-liver oil as a feed supplement. Alternate calves of the 72 head were given 25 to 35 c.c. of cod-liver oil daily, the others serving as controls. Otherwise, all were fed alike. There were fewer cases of digestive trouble in the treated calves, but in regard to the rate of growth measured at the withers, there was no difference in the gains made. Beginning at 90 days, however, the Guernseys and Jerseys made an average gain in weight of 22.5 and 17.5 pounds (10.2 and 8 kg.), respectively, over the untreated calves of those breeds during the experimental period (180 days), the Holstein-Friesians showing no similar effect. Whole milk was fed during the first 30 days and skim milk thereafter. The better response in the Guernseys and Jerseys than in the Holstein-Friesians was attributed to the difference in the ability of these breeds to utilise vitamin A contained in feed. At the age of 90 days, when the reserve of vitamin A and carotene obtained from the whole milk diet during the first 30 days was exhausted, the Holstein-Friesians showed their greater ability to utilise these factors from roughage.

‡ *Journal of Diary Science*, May, 1944.

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SPIROCHETAL JAUNDICE—LEPTOSPIROSIS, OR WEIL'S DISEASE*

THE disproportion of both human and animal cases of spirochetal jaundice in the United States and in Europe is outstanding. In Holland alone, from 1924 to 1937, 808 human cases were diagnosed. In Great Britain, 248 cases were reported during that period. In contrast, up to 1942 only 73 authentic cases are on record for the United States, notwithstanding that the transmitting hosts (rats) of the specific agent are not lacking in this country. The discrepancy is attributed to the similarity of this spirochetosis to other infections manifested by prostration, fever, myalgia, leucocytosis, and signs of liver and kidney damage. Although statistical data remain incomplete, investigations carried out by veterinary medical associations and private practitioners indicate that the disease is found to be quite common in various parts of the United States since recognised standards of detecting the presence of the specific agents, *Leptospira canicola* and *icterohæmorrhagiæ*, have been employed.

* *Journal of the American Veterinary Medical Association*, February, 1944.

THE BLOOD-VOLUME OF ANIMALS†

THE average plasma volume of animals depends upon their bulk and is unrelated to the rate of metabolism. The blood-volume of 30 goats determined with the blue dye T-1824 showed that the plasma value by weight was 53 c.c. per k.g. of body weight, and volume of total blood 70 c.c. per kg. The same proportions apply to rabbits, dogs and horses, and they are in no degree related to surface area. Cell volume is a factor, as was shown in the study of highly-trained greyhounds, which had a much higher blood-volume than ordinary dogs.

† *Journal of Physiology*, December, 1943.

DDT. TREATMENT OF MANURE TO CONTROL THE HOUSE FLY‡

DDT. (2, 2-bis. (parachlorphenyl)-1, 1-trichlorethane), sensational synthetic insecticide, developed by the U.S. Department of Agriculture, was tested against the larvæ of the house-fly (*Musca domestica L.*) in Florida. The formula used consisted of :—

DDT.	10 gm.
Benzene	12.5 c.c.
B.-1956 (phthalic glyceryl alkyd resin) ...	2.5 c.c.
Water	75 c.c.

The diluted emulsions were applied with a spray at 350 pounds (159 kilograms) pressure. Heaps of cow manure, 16 cubic feet (0.5 cubic meter) in volume, well infested with larvæ and pupæ, were treated with 8 to 10 U.S. gallons (30 to 38 litres) of emulsion and caged for 67 days, at which time 13 flies emerged from the treated heaps and 555 from the control heaps. Dead larvæ were found in the treated heaps two days after spraying. Over a 65-day period only two flies emerged from two of the heaps treated with DDT. 0.5 per cent. emulsion and 1,008 flies emerged from one of the control heaps. There were no flies from the heaps treated with 0.25 per cent. DDT after 18 days. Tests against the stable fly (*Stomoxys calcitrans L.*) gave essentially comparable results.

‡ *Review of Applied Entomology*, November, 1944.

CAMPAIGN AGAINST CATTLE BUGS—WARBLES*

WORKING jointly, the Bureaux of Animal Industry and Entomology, U.S. Department of Agriculture, have developed practical herd treatment for grubby cattle. In small herds of gentle dairy cows, removal of the "ripe" grubs by manual pressure around the base of the warble was standard treatment; however, in large herds of intractable range cattle, with perhaps hundreds of warbles strewn aroung the back, no effective treatment was available until reliable larvicide drugs, easy to apply, were discovered. Mixtures of derris or cube containing 5 per cent. of the active principle, rotenone, diluted 1 to 2 with buffer, dusted freely over the warble-ridden backs and hand rubbed, can be administered rapidly to cattle as they file along the chute; or the same drug mixed with wettable sulphur and water, 7.5 pounds per 100 gallons (900 grams per hectoliter) sprayed over the backs under 400 pounds (182 kilograms) pressure, may be employed in lieu of the powder. As warbles do not all "ripen" at the same time, the treatment is repeated in 30 days.

It is estimated that grubs cause the cattle branch of the livestock industry of the United States a $100,000,000 loss annually in meat, milk and leather. In 1923, Herms, a distinguished entomologist, set the damage at $123,000,000 a year. American tanners estimate the loss from damaged leather at $10,000,000. Danish veterinarians declare that there is a 25 per cent. decrease in milk production among grubby cows. The loss of meat poundage through unthriftiness is more difficult to reduce to figures.

By cattle grub infection is meant the larvæ of the heel fly, *Hypoderma lineata* of the southern states, or its counterpart, *Hypoderma bovis* of the more northerly latitudes. In the southern latitudes the treatment is given in September and October, and in the north in February, March and April. In the United States the warbles appear on the back nine months after the fly deposits her eggs on the heel hairs.

* *Circular, National Live Stock Prevention Board, Chicago,* 1944.

RADIO BEWILDERS HOMING PIGEONS†

SINCE the war has brought the use of homing pigeons to a new peak of reliability as carriers of messages, there is much importance to be attached to the effect of the radio on their homing instinct. The belief that the radio retards their flight was supported by a series of tests conducted by the Signal Corps of the U.S. Army, in which some groups of pigeons were released from a radio station during transmission and others during silence.

Three groups of ten pigeons, each subdivided into groups of five, were released at different times from the radio station for a ten-mile (16-kilometre) flight. The groups loosed while the radio was operating were bewildered. They circled erratically around the station for 15 to 20 minutes before taking off to the reception loft, ten miles (16 kilometres) away, and arrived at their destination in 42 to 52 minutes. The groups released while the radio was silent did not hesitate, and arrived in 18 to 21 minutes.

The birds were of the same type and training, and conditions were equal for each test. The trials showed that while all birds released while the radio was transmitting bungled their tasks, those released during radio silence performed normally. Final conclusions are to be withheld pending a greater number of trials.

† *Army News, Publication Branch, Bureau of Public Relations, U.S. War Department,* January, 1-15, 1945.

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COBALT DEFICIENCY IN CATTLE IN UPPER MICHIGAN*

For many years dairy cattle of the Upper Peninsula of Michigan have suffered from unthriftiness, which in 1942 workers of the Michigan Agricultural Experiment Station identified as cobalt deficiency. Many herds were included in the study. The symptoms observed were gradual loss of appetite and rapid loss of thriftiness, followed by depraved appetite (wood chewing), all more frequent among young stock than among mature cows. Blood studies showed low hæmoglobin concentration and ill-shaped erythrocytes. Plasma calcium, inorganic phosphorus, and magnesium did not account for the condition, but the administration of cobalt sulphate brought about marked improvement in the appetite and condition, increased the hæmoglobin concentration, and reshaped the red cells. The cobalt sulphate was administered by adding 0.5 ounces (15 grams) to 100 pounds (45 kilograms) of salt and allowing the cattle free access to it, or by dissolving in water 1 ounce (30 grams) to a gallon (4 litres), and giving one tablespoonful in the milk of each calf for seven days and thereafter one teaspoonful per day. Since the study was made the trouble has been corrected by supplementing the feed of cattle in the affected districts with cobalt.

* *Journal of Animal Science*, November, 1944.

CAROTENE REQUIREMENTS OF CATTLE†

The ability of cattle quickly to convert carotenoids into vitamin A and store it in the liver for use as needed is subordinate to the character of the forage consumed. But, inasmuch as the needs vary with age, pregnancy, work, lactation and health, the relation of the carotene intake and vitamin A reserve to these vicissitudes is of more vital importance in the production and use of cattle than in any other class of farm animal. In cattle husbandry none of the other micronutrients is of comparable significance. The pregnant cow draws heavily upon the vitamin A reserve to nourish her fœtus and to establish a high concentration of it in the colostrum to supply the immediate needs of the newborn, which is normally low in vitamin A at the moment of birth. Basically, the vitamin A requirement of young calves is approximately twice that of the pregnant mother, and eight times that of the growing heifer later in life. The viability of the newborn calf depends largely upon receiving the abundance of vitamin A needed, during the first 48 hours, to fortify the digestive and respiratory mucosæ against the infections expressed in the form of fatal scours and pneumonia.

Though adult cattle may long survive low carotene intake, calves cannot. The intake of vitamin A in calves must be regulated with measured accuracy to attain maximum results. The essential factor is feeding the pregnant mother with forage having a high concentration of carotene, or, in lieu thereof, to supplement the feed with a synthetic substance. In no event should the vitamin A intake be overlooked in cattle production. Controlled experimental work conducted at the agricultural experiment stations of Wisconsin and California have established a "new dimension" for carotene in cattle production.

† *Nutrition News Bulletin*, January, 1945.

THE UNIVERSITY OF LIVERPOOL EXAMINATION LIST, JUNE, 1945

SCHOOL OF VETERINARY SCIENCE

Degree of M.V.Sc.—G. H. Arthur, A. H. Mahmoud, K. Unsworth.

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Reviews

Livestock Improvement in Relation to Heredity and Environment. By J. E. NICHOLS. Pp. vii + 208. 8vo. London and Edinburgh: Oliver & Boyd, Ltd. 10s. 6d.

LIVESTOCK improvement, particularly in so far as it concerns the breeding of dairy cattle, has of late received great attention in the various sections of the agricultural Press of this country. This subject, likewise, is not without considerable interest to the veterinary profession, for we believe that the practitioner especially, by virtue of his intimate contacts with farmers and breeders, and by his prestige in matters appertaining to animal health, could exercise a potent influence in the promotion and encouragement of livestock improvement, provided that he were well informed in the scientific principles underlying this important branch of animal husbandry. Apart from a few notable exceptions, however, it must be admitted that the veterinarian in general has not been able to assume that role in connection with livestock improvement, for which all his other training and experience in animal matters singularly befits him. This may be accounted for in part by the fact that until comparatively recently the subject was not included in the professional curriculum, and partly because there has been no adequate text-book of animal breeding which has special reference to British conditions and requirements. This book by Dr. Nichols should go some way towards eliminating this latter handicap. The author is Deputy Director of the Imperial Bureau of Animal Breeding and Genetics, Edinburgh, and was formerly Professor of Agriculture in the University of Western Australia; he has, therefore, had the opportunity of studying the methods of animal breeding both in the British Isles and in one of the great Dominions.

In the preface the author states that his aim is "to outline the principles (of formal genetics) and to indicate how the genetic and environmental concepts are interwoven in the idea of stock improvement." He approaches the study of genetics applied to livestock improvement, not simply as a matter of chromosomes and genes, but in a broader and more practical sense than is usually found in the standard text-books. The fact that the living animal is ever the end result of a series of complex interactions between its hereditary make-up and its environment is never lost sight of. After an outline of the mechanism of inheritance and the modern concept of gene interaction and character frequency, the author proceeds in a particularly valuable chapter to a consideration of the part played by the environment-genetic relation in the pre- and post-natal development of the individual. The age-old problem of distinguishing between the effects of Nature and nurture are here fully discussed by reference to recent work. "The breeder is confronted with two main problems, that of trying to distinguish between the effects of heredity on the one hand and of environment on the other, and that of providing an environment suitable or optimal for the expression of the particular characteristics." With regard to the second of these problems, it is emphasised that the animal be placed in a ***suitable*** environment in order that it may have the opportunity of expressing its genetic constitution. But, as the author is careful to point out, the best possible environment is not necessarily the most suitable in which to carry out the selection of animals for utility purposes. "An extreme improvement in environment may in effect

mean exposure to highly artificial situations such as either the bulk of the population would rarely encounter in practice or would amount to a new environment requiring a different gene complex for a successful fit. The safer general course is to keep the animals as far as possible under those environmental conditions in which they are expected to perform, in which they are to be used, and therein to consider the possible relative significance of the genetic and the environmental influences." To the reviewer this consideration seems of fundamental importance in any practical livestock improvement policy, and one which appears to have been largely ignored by the official and non-official "enthusiasts" who so loudly advocate breeding schemes as the sole remedy for effecting an improvement in the performance and status of the general average of British cattle. We submit that an improvement in the environment on the broadest basis, including management, nutrition and freedom from disease, is a prerequisite of any animal improvement campaign. In the final chapter of the book, Nichols returns to this topic in dealing with the ecological implications involved in the selection of stock for a particular environment. The concluding sentence of the book probably fairly summarises the author's attitude to this problem. "Whatever its direction, the policy of improvement should be re-examined in relation to the general pattern of the environment, and the appropriate mating systems and selection methods chosen according to what is known of their effects, of which an account has been attempted here."

Elsewhere in the book, the genetic aspects of selection, inbreeding, linebreeding and outbreeding are adequately dealt with, and should provide a useful explanation of the methods and systems of breeding, which have been more or less empirically followed by the great "livestock improvers" of the past. The author's analysis of individual performance tests and of progeny testing as methods of improvement should be studied by all who are in any way connected with breed improvement.

The subject matter of this book is so condensed that it needs careful reading in order to master its details. In some respects it resembles a monograph rather than a conventional text-book, and we venture to suggest that it would make for more clarity if, in the second edition, the chapters were sub-divided and appropriate sub-headings inserted. One point of criticism may be that there is no reference to the various livestock improvement schemes in Great Britain; one would have liked, in view of the current interest, to have had the author's analysis of these, in view of his wide experience elsewhere. To some critical veterinary readers, too, it may seem an omission that no mention is made of the Horsebreeding Act, the value or otherwise of which has for long provided a fruitful source of discussion in some veterinary circles. These, however, are minor points, and in no way detract from the value of a book, which is mainly concerned with the exposition of principles, and which is obviously intended for a wider field of readers than those in Great Britain alone.

N.J.S.

Radiology in Canine Practice. By G. SCHNELLE. Published by North American Veterinarian, Inc., 1945. Pp. 326. 248 illustrations. Price $5.

THE practitioners of twenty years ago would have been surprised indeed if they had been presented with a specialist book of this kind; in truth it never could have been published. Only by the pioneer work of a select few in our profession during the last 10 or 15 years has the undoubted benefit and value

of diagnostic X-rays been clearly demonstrated to the world. The information which has accumulated within that period has made possible the production of a volume entirely devoted to this subject.

The foreword of Dr. Osman states: "This monograph by Dr. Schnelle is the first text-book in the English language on the subject of veterinary radiology. That alone has made the compilation and preparation of material more difficult, as there are no references to consult and no similar work for comparison." This, of course, is not strictly correct, as we reviewed in 1939 an English work of over 580 pages, more than half of which (including 120 radiographs) was devoted to radiographical diagnosis in small animal practice. Thus there seemed plenty of material here for consultation and comparison. That text-book must actually be regarded as the pioneer in veterinary radiology, and Dr. Schnelle wrote for it a very eulogistic foreword.

It is true to say, however, that Schnelle has produced a work which is devoted entirely to radiology and to nothing else, and we welcome it heartily. The book gives a clear exposition of the principles and working technique of radiography which the veterinarian who contemplates becoming an X-ray worker would do well to study. It is printed nicely on very good quality paper, and is "handy to handle."

As film-processing is of such extreme importance in the production of clear readable radiographs, it is to be regretted that no detailed advice on dark-room procedure is offered.

A useful feature of the book is that radiographs are given of normal or healthy parts for purposes of comparison; yet, unfortunately, many of the figures gravely lack clarity of detail. In some the subject appears to have moved; in others there seems to have been under-exposure; in many there is a regrettable fogging which entirely baffles the uninitiated and renders the pictures valueless.

Little clarity of detail will be found in Figs. 10, 12, 16, 17, 28, 74, 76, 78, 79 or 226, all of which are indistinct and of poor quality, so that the pathological conditions which the author seeks to demonstrate cannot be recognised. Nothing whatever can be seen in Figs. 22 and 27.

We realise the inherent difficulties attending the radiography of non-co-operative, tiresome and nervous animals, and gladly overlook the faulty work in view of the general excellence of the whole. It is, no doubt, inevitable that some loss of quality must occur when films are reduced to such very small dimensions as will permit of their publication in a small volume.

The author very wisely emphasises the need for protective measures being adopted by the radiologist in order that he shall suffer no disability through constant exposure to small doses of rays possessing a cumulative property.

We cannot find ourselves in agreement with some of the diagnostic conclusions arrived at by the author. For instance—and without expatiating at length—there is no evidence either in the clinical description or in the radiograph that Fig. 58 (and repeated in Fig. 113) depicts an osteomyelitis. It differs in no way from ordinary phalangeal fractures which we have commonly encountered in practice and confirmed by X-ray. There was no history of constitutional disturbance, and such bone changes as are present are those which would normally be expected to follow continuous irritation by use of the limb for three weeks without treatment.

We question also the diagnosis of Figs. 59, 60 and 61; in fact, the only

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radiograph which would seem to conform to a case of true osteomyelitis is Fig. 62, doubt being entertained re Fig. 64.

The subject of Fig. 65 appears, in our view, to have suffered from telangiectatic osteosarcoma and not from fibrosarcoma, as it is identical with films we have seen in which histological identification has been established. The term fibrosarcoma could, in our view, be properly applied to Fig. 66.

Mention is made on page 127 of "slipped" intervertebral disc. Such a lesion has not been encountered by us in 17 years of radiographical experience, and Schnelle nowhere illustrates one. It is difficult to understand how the anatomical structure could permit of such movement. Fig. 81 shows a calcified disc, said by the author to have "slipped" prior to its being radiographed; but there is no pictorial evidence whatever that the disc is in any but its normal position. It is interesting to find that Schnelle recognises calcified intervertebral discs as a cause of paraplegia.

There is no doubt whatever that radiology must be increasingly resorted to as the public becomes ever more aware of its availability and its aid to accuracy. Nearly six years of war have imposed upon the science a severe setback, as during that time no apparatus was obtainable. It behoves small-animal practitioners to employ X-rays more fully in diagnosis, not only that more accurate curative measures and prognoses may follow, but also that their own reputations may not suffer.

H.K.

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